

Effect of reducing soil pH with sulfuric acid on potato scab

Purpose

Nitrite becomes converted to nitrous acid under acid conditions. At about pH 4.3 nitrite and nitrous acid are in equilibrium (50:50). Nitrite has no toxicity to microorganisms such as *Streptomyces scabies*, the bacteria that causes potato scab. Nitrous acid at 0.03 mM however, is lethal. In order to obtain sufficient amounts of nitrous acid it is necessary to lower soil pH for a short time to about pH 4 - 5. This study was carried to determine the effect lowering the pH, in the absence of nitrite, on disease incidence caused by *S. scabies*.

Materials and Methods

Soil known to have high disease pressure for potato scab was collected from a commercial potato field in Ontario in the spring of 2001 and brought to the London research station. An experiment was set up using microplots. Soil (13 kg) was placed in drainage tiles (25 cm deep, 25 cm diam) that had been buried in soil to ground level. The soil pH in some soils was reduced by adding sulfuric acid (45%, obtained from Ethyl Canada Ltd., Sarnia, ON). Acid (7.2 and 16.9 mL) was added to water (390 mL) and the water was then added to soil. The pH was found to reduced from 6.5 to about 5 and 4, respectively (Fig. 1). One week later, a potato seed piece was planted in each tile (four tiles per treatment). The tubers were harvested in the fall and the and rated for scab on a scale of 0-6 based on the percentage of tuber surface covered with scab lesions where 0 = 0%, 1 = trace to 5%, 2 = 6-15%, 3 = 16-25%, 4 = 26-35%, 5 = 36-60%, and 6 = 61-100%.

Results and Discussion

Soil pH was reduced to 5 and 4 at day zero by the addition of sulphuric acid (Fig. 1). Within 2 days however, the pH in acidified soils was up by half a log unit and at the end of a week a full log unit (Fig 1). Since nitrous acid kills *S. scabies* bacteria within hours the length of time the pH stayed low would have been more than sufficient to control disease. By week 6 the pH was nearly identical in both treatments to the control soil (Fig. 1). At harvest we found no effect of pH alterations on the severity of potato scab as compared to the control treatment (Fig. 2). Scab severity was near maximum in all treatments. This demonstrates that low pH and acid alone has no effect on disease incidence.

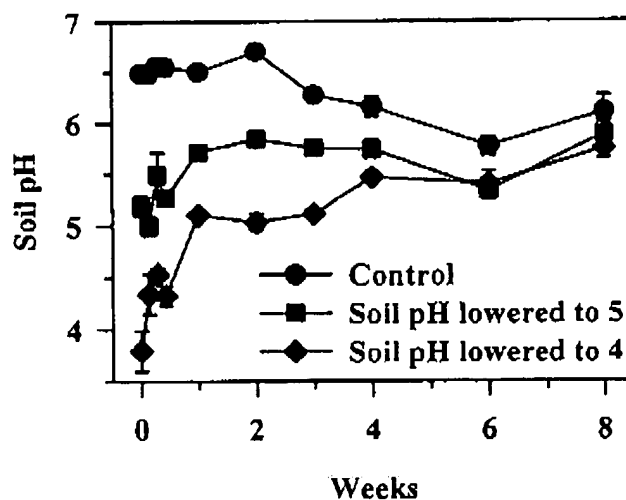


Figure 1. Reduction of the pH of a soil from a commercial potato field in Ontario using sulfuric acid. Soil pH was then monitored for 8 weeks. Error bars represent S.E., $n = 4$.

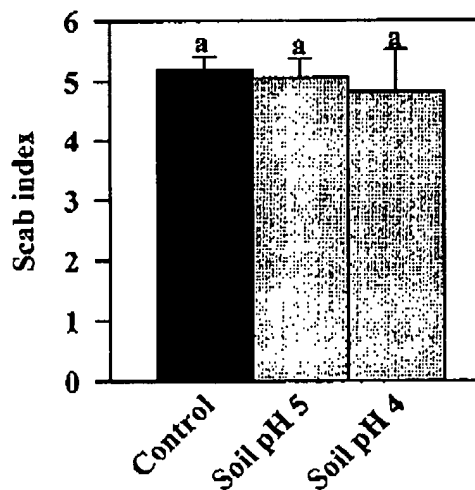


Figure 2. Effect of reducing soil pH on potato scab severity. The pH of a soil from a commercial potato field was reduced with sulphuric acid (see Fig. 1). Potatoes were planted 1 week later and tubers harvested in the fall were rated for scab on a scale of 0-6 based on the percentage of tuber surface covered with scab lesions where 0 = 0%, 1 = trace to 5%, 2 = 6-15%, 3 = 16-25%, 4 = 26-35%, 5 = 36-60%, and 6 = 61-100%. Error bars represent S.E., $n = 4$. Treatments with the same letter are not significantly different at the 0.05 probability level.